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UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

Project h-1-13:1 Date May 1939 Author W. J. Buckhorn

TITLE

REPORT OF PINE-BEETLE SURVEYS on the OCHOCO NATIONAL FOREST 1931-1937

Forest Insect Laboratory
445 U. S. Court House
Portland, Oregon

U.S. GOVERNMENT PRINTING OFFICE 8—0742

SUBJECT—

INDEX NO.—

REPORT OF PINE-BEETLE SURVEYS
on the
OCHOCO NATIONAL FOREST
1931-1937

Approved by:

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Forest Insect Laboratory
445 U. S. Court House
Portland, Oregon
May 1939

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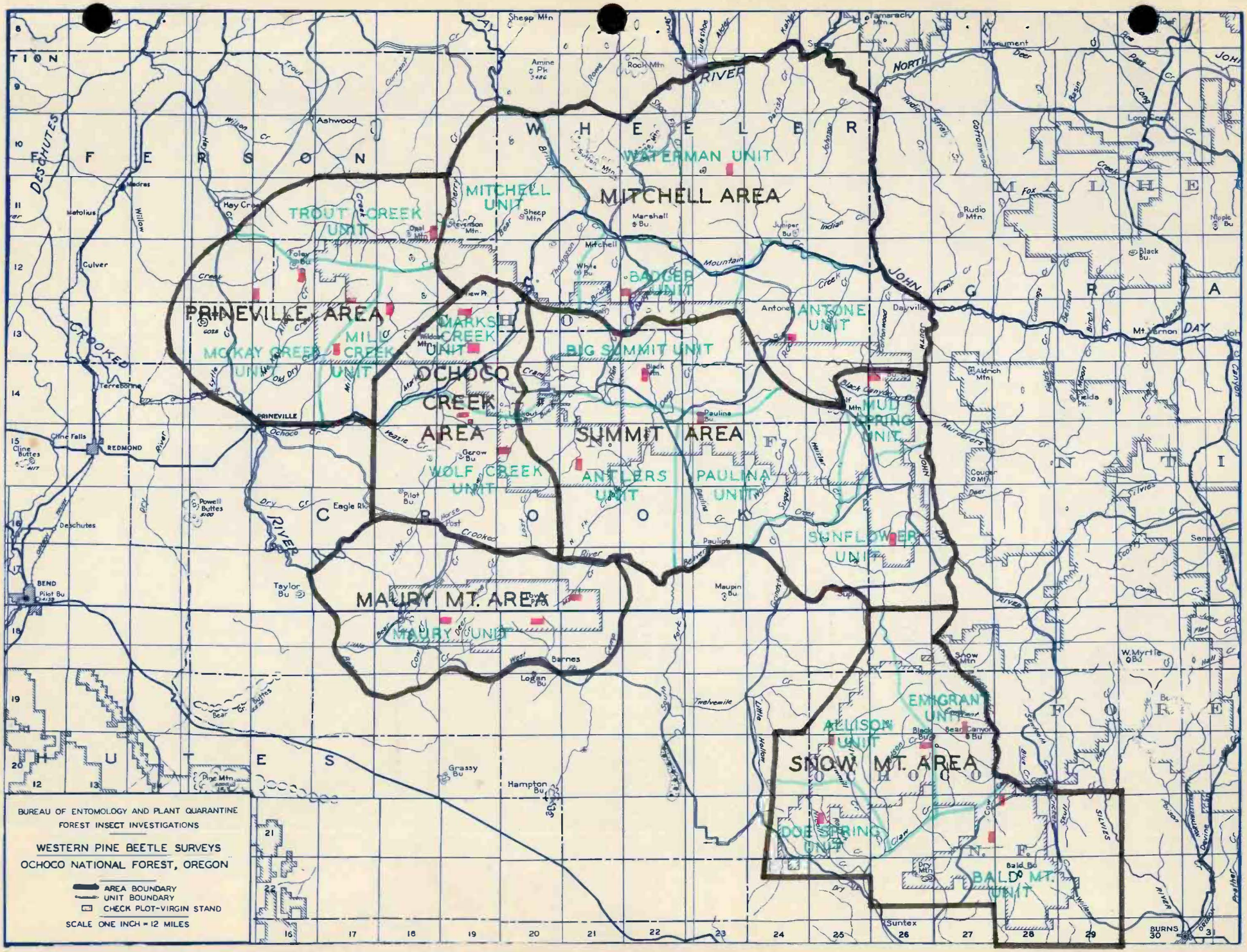
PRINEVILLE AREA
MITCHELL AREA
OCHOCO CREEK AREA
SUMMIT AREA
MAURY MT. AREA
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TROUT CREEK UNIT
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Introduction.

Depredations of the western pine beetle (Dendroctonus brevicomis Lec.) have been observed by forest officers and timber owners in the ponderosa pine stands of the Ochoco National Forest and adjacent private lands over the past several decades, but it was not until 1931 that a plan of systematic annual surveys was inaugurated as a cooperative undertaking of the Forest Service and the Portland forest insect laboratory of the Bureau of Entomology and Plant Quarantine. Since then, surveys have been conducted annually to determine the yearly trend, intensity, and distribution of the infestation; to ascertain the need for artificial control work; and to study the effects of control work. The surveys also served to familiarize the forest personnel and timber owners with existing insect problems and to increase their interest in this phase of forest protection work.

Under the cooperative arrangement between the Forest Service and the Bureau, the Forest Service has employed field assistants, CCC enrollees, or student assistants to carry out the field work, and the Bureau has furnished the technical supervision of these crews and has made the extensive surveys on which the general loss estimates have been based.

History of the Surveys.

On November 11, 1932, the first sample plot consisting of 320 acres was established on the Ochoco. Five 320-acre plots were established during November and December 1932. Since then, 121 additional plots have been established. Ten of these have been cruised annually since their establishment in 1932-33. The average number of plots cruised each season was 22, the number varying as new plots were established, and those having served their purpose or proved unsatisfactory were eliminated.

During September and November 1933, the five plots established in 1932 were recruised and 39 additional 320-acre plots were established by three crews of field assistants and one CCC crew. In 1934 the number of plots was reduced to 15. These were cruised during September and November by three crews of field assistants. The 1935 survey was carried on during August and September. This consisted of a 100 percent beetle loss cruise of 23 sample plots and an extensive beetle survey of the entire forest to determine the severity and extent of the infestation in the ponderosa pine stands. The extensive survey was made by gridironing the ponderosa pine stands with strips five chains wide and eight to ten miles long. These strips included a complete count of recent and old beetle losses for each mile.

In 1936 the intensive plot work was started early in July by a crew of CCC student enrollees. Later their work was supplemented by a crew of field assistants who, with two other survey crews, had received one week of intensive training at Camp Sisters, Deschutes National Forest, under A. J. Jaenicke and W. J. Buckhorn. This crew carried out a program of sample plot work and extensive strip work. Altogether, 19 plots were cruised in 1936 during the period July 10 to August 19.

Before assuming field duties, the 1937 survey crew of CCC student assistants, all of whom had one or two years of forestry training in college, was given three weeks of intensive training under Messrs. Jaenicke and Buckhorn at Camp Sisters. In 1937 a ten percent cruise of the green timber by Keen's tree classes was made on the sample plots in addition to the usual 100 percent tally of the recent beetle losses. Twenty-five plots were cruised from July 15 to September 1 in this manner.

The 1938 survey crew, composed of graduate forestry students, received two weeks of intensive training at Camp Sisters prior to starting field work in their assigned territory. Twenty-five plots were recruised for current losses and three new plots were established on which a 10 percent cruise of the green stand was made. Old losses were tallied and notes were taken on ecological conditions. The work was carried out during the period July 25 to September 8. The locations of the plots cruised in 1938 are given in the frontismap.

To supplement the strip work of former years, a general estimate of the 1937 loss per section was made in 1938 for the whole forest. Data obtained from plot work were used as a measure to gauge surrounding conditions. As one of the aids in obtaining the field data for this general estimate, observations were made by the writer from all but one primary and one emergency lookout on the forest, as well as from numerous other points of ventage and along many roads on the forest.

The personnel who assisted in making the annual surveys on the Ochoco since 1932 are as follows:

Year	Personnel	Supervised by
1932	F. W. Schlegel, L. Cunningham, F. Cunningham, J. M. Whiteside, Field Assistants.	Jaenicke
	A. J. Jaenicke, Regional Office; H. Obye, Supervisor's Office; W. J. Buckhorn, Bureau of Entomology and Plant Quarantine.	
1933	L. V. Hunter, C. E. Hein, C. Francis, Field Assistants; F. P. Keen, and W. J. Buckhorn, BEPQ.	Keen
	F. W. Schlegel, E. Adams, C. Adams, Field Assistants; F. P. Keen and W. J. Buckhorn, BEPQ.	Keen
	B. Becker, E. Huff, and J. M. Whiteside, Field Assistants.	Jaenicke
	McKenzie, Bennett, Landholm, Davis, W. J. Brunner, CCC enrollees.	J. A. Beal
1934	D. L. Lynch, F. Cunningham, C. Francis, Field Assistants.	Jaenicke
	O. Mizer, E. Mizer, Field Assistants; W. J. Buckhorn, BEPQ.	Buckhorn
	J. H. Wood, B. Johnson, C. I. Gordon, Field Assistants; W. J. Buckhorn, this Bureau.	Buckhorn
1935	R. G. Glasgow, R. Coiner, E. Mizer, B. Becker, Field Assistants.	Buckhorn and Jaenicke
1936	H. Dixon, E. Mizer, O. Potter, Field Assistants.	Buckhorn & Jaenicke
	N. Knott, L. Lord, C. B. Reynolds, T. C. Taylor, F. Curry, CCC student enrollees.	Buckhorn
1937	R. T. Files, F. M. Hood, H. F. Hatz, P. Maliytes, W. Hagenstein, Field Assistants.	Buckhorn
1938	H. Carson, S. B. Cross, W. G. Petersen, Field Assistants.	Buckhorn

Forest Description.

The Ochoco National Forest is the most westerly of the Blue Mountain group. It occupies a large portion of Crook County and lesser portions of Jefferson, Wheeler, Grant, and Harney Counties in Oregon. The topography varies from a gently rolling to a rough terrain. The general range in elevation is from about 3,000 to 6,000 feet, with a few higher peaks.

Approximately 96 percent of the timbered areas are in the ponderosa pine type. Mixtures of Douglas fir, white fir, larch, and occasionally lodgepole pine are found only at higher elevations and on north slopes.

The forest has been exceedingly fortunate in not having had any large disastrous fires within the life span of present timber stands. Prior to 1937, logging was confined to supplying a few small local mills, and the total acreage of cut-over land probably did not exceed 17,000 acres. With the installation of two new mills with larger capacity, one on McKay Creek during the fall of 1937, and the other at Prineville in the fall of 1938, the removal of pine stands will be greatly accelerated.

Area Descriptions.

From an entomological viewpoint, the forest and adjoining lands have been divided into six infestation areas which, in turn, have been subdivided into 19 units. (See frontismap.) These areas are more or less natural divisions of the forest, since the boundaries follow natural features such as ridge tops, large openings, or changes of type. These six infestation areas are briefly described in the following paragraphs:

Prineville Area. This area lies at the northwest end of the forest, embracing drainages of Trout and Willow Creeks to the north and west, and McKay and Mill Creeks to the south. A large portion of the cut-over lands lies within this area.

Ochoco Creek Area. The drainages of Marks, Ochoco, and Wolf Creeks, Wickiup, Horse Heaven, and Lost Creek comprise this area. This and the Prineville Area contain nearly all the cut-over acreage on the forest.

Summit Prairie Area. This area lies on the south slope of the Crooked River watershed between Lookout Mountain on the west, the divide between the John Day and Crooked River Watershed on the north, and the south fork of the John Day River on the east. Except for a very small portion on the east, the drainage is into the Crooked River.

Mitchell Area. This area lies along the north boundary of the forest. It includes most of that part of the Ochoco Forest which is drained by the John Day River or its tributaries.

Snow Mountain Area. This area includes all of the detached portion of the forest adjoining the Malheur Forest on the east and bordering the desert on the north, south, and west sides.

Maury Mountain Area. This is a completely isolated body of timber seven or eight miles south of the main forest, forming an excellent entomological unit.

Data from the inventory phase of the Forest Survey 1/ show approximately 874,000 acres in private and government ownerships within and adjoining the Ochoco National Forest. This timbered acreage contains 8,500,567 M board feet of commercial ponderosa pine. The division of acreage and volumes by infestation areas as of January 1, 1937, is given in table 1.

Table 1.—Acreages and ponderosa pine volumes.

Area	Timbered Acres	Total Pine Volume Mbm	Volume per Acre Mbm	Susceptible Volume (Types 5-20.5)
Mitchell	122,000	1,103,000	7.0	1,000,000
Prineville	148,000	1,550,000	10.5	1,350,000
Ochoco Creek	137,000	1,591,000	13.2	1,400,000
Summit Prairie	193,000	1,944,000	11.1	1,750,000
Snow Mtn.	219,000	1,860,000	8.5	1,700,000
Maury Mtn.	55,000	447,000	8.1	400,000
Totals	874,000	8,500,000		7,600,000

1/ USDA—Forest Service—Pacific Northwest Forest Experiment Station.
Forest Statistics for Jefferson County, Oreg., Paul D. Kemp, 4/15/36.
" " " Crook County, Oreg., Harry M. Wolfe, 5/25/37.
" " " Wheeler County, Oreg., F. L. Moravets, 6/20/37.
" " " Grant County, Oreg., Walter E. Pelto, 8/5/37.

Climatic Phenomena, 1931-38, as Affecting Insect Activity.

Drought. The cumulative effects on timber growth of the drought which began about 1917 were critical at the beginning of this decade. Seasonal precipitation in eastern Oregon from September 1, 1930, to September 1, 1931, was 22 percent below normal. This resulted in reduction of tree growth and greatly lowered vitality of the pine stands. Growth conditions have somewhat improved during the past few years as a result of better moisture conditions.

Wind. On April 21-22, 1931, a northeast wind of cyclonic violence swept over the eastern portions of Oregon and Washington. Damage to forests varied considerably. The greatest damage on the Ochoco occurred on the Prineville, Ochoco Creek, and Maury Mountain Areas. Crests of northeast exposures were hardest hit, in some instances practically leveling the stand. Gusts of wind descended into protected areas and canyon bottoms, bowling over many of the finest trees. In addition to blowing down an unknown volume of timber, the hurricane left much standing timber in a badly shaken and weakened condition.

Low Temperatures. Temperatures sufficiantly low to cause mortality to overwintering broods of the western pine beetle have occurred five times during the period 1931-38. First and second periods occurred during the winter 1932-33, on December 11, when minus 19° F. was recorded, and on February 25 when minus 26° F. was recorded. These temperatures caused a brood mortality of 69.1 percent.2/ Due to this high mortality, control operations on the McKay Creek Project were suspended by both private and federal agencies. The third cold period occurred unseasonably early during the fall of 1935, when minus 15° F. was recorded on November 3.3/ This caused a 12 percent mortality of pine-beetle broods. The fourth and fifth cold periods occurred during the winter of 1936-37, when on January 8, minus 36° F. was recorded 4/, and on January 20, minus 33°F, which resulted in a brood mortality of 67.1 percent.

2/ "Low temperatures as a limiting factor in western pine beetle epidemics, 1933"—F. P. Keen, Entomologist, and J. A. Beal, Assistant Entomologist.

3/ "Additional observations of the effects of low temperatures upon overwintering populations of Dendroctonus brevicomis, 1935"—R. L. Furniss.

4/ "Memorandum on western pine beetle mortality, 1936-37"—R. L. Furniss.

Pine-Beetle Damage.

1916 to 1930, inclusive. During this period the western pine beetle situation on the forest was not a serious one, except during 1925, 1929, and 1930, when beetle losses became increasingly prevalent in many localities. These increasing losses were probably due to the gradual decline in tree thrift, brought on by the long drought period.

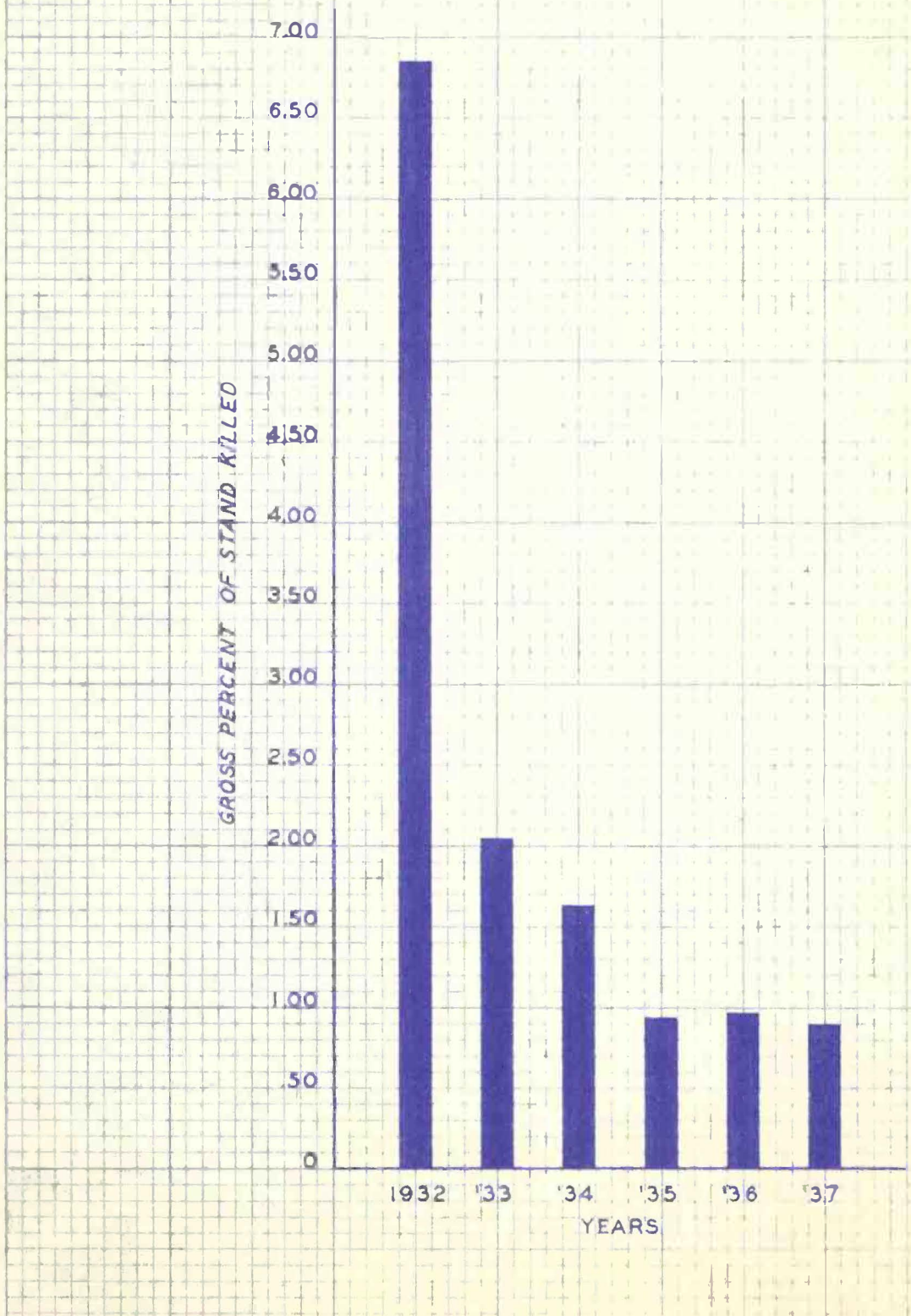
The history of the western pine beetle situation in the Snow Mountain region, as summarized by former Ranger E. W. Donnelly, is quite typical of the Ochoco Forest as a whole. From 1916 to 1918, dying trees were rare in the Snow Mountain District. In 1918-19 a light epidemic developed, which soon became quiescent and remained so until 1924-25, when activity again became noticeable. The beetle activity then subsided, but reoccurred with greater severity during 1928. The rather high level of 1928 was maintained through 1929. The infestation increased considerably during 1930 over that which was prevalent in the Snow Mountain District in 1929.

1931 to 1933, inclusive. Due to the critical condition of the pine stands from drought and wind, the infestation which became aggressive during 1930 in many parts of the Ochoco Forest mounted rapidly upward during 1931. It reached its greatest intensity in 1932, when 4.79 percent of the entire pine stand was killed. Even greater losses occurred on certain areas. One 80-acre sample plot on the Snow Mountain Area lost 17.56 percent, and two 320-acre sample plots on the Prineville Area lost 11.06 and 10.36 percent of the stand during 1932. Due to the low temperatures in the winter of 1932-33, when 69.1 percent of the overwintering broods were killed, the infestation dropped abruptly during 1933. Except for an occasional flareup in localized areas, the infestations continued the downward trend and reached their low point in 1937. The fluctuations in this epidemic cycle are shown graphically on figure 1 accompanying this report. The severity of the 1937 beetle losses in various parts of the Ochoco is given in the map which immediately follows the frontismap.

Table 2 gives detailed loss figures for various sample plots since they were established. Table 3 summarizes these records. Table 5 gives the estimated losses for 1937 on each unit and infestation area. The distribution of these 1937 losses in various degrees of severity is shown on the frontismap.

FIG. NO. 1

TREND OF CHECK PLOT LOSSES
OCHOCO NATIONAL FOREST, OREGON



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The estimated losses for each of the six infestation areas from 1931 to 1937 are shown in table 6. The 1938 survey was conducted from July 25 to September 8, when only a part of the total 1938 losses had occurred. Previous experience shows that up to 50 percent of the total year's losses would be included in a cruise made during this period. On this basis, the 1938 beetle losses were computed. They are given in table 4.

Control Work.

From the fall of 1932 to the spring of 1937 a large amount of control work has been conducted by both Forest Service and private owners on the Prineville, Ochoco Creek, and Maury Mountain Areas. The period of work, number of trees treated, and cost of control are shown in table 7.

As low temperatures fatal to overwintering broods of the western pine beetle occasionally occurred when control work was being done, and since the general trend of the infestation was downward, it is impossible to measure the effect of the control work in breaking up the epidemic. However, there is ample evidence in support of the conclusion that the control work helped break up the large concentrations of beetle population and assisted natural factors in bringing about a more rapid decline of infestation on the areas covered by control operations. The somewhat delayed decline of the infestations in ponderosa pine stands not included in the control work adds strength to this conclusion.

Conclusions and Recommendations.

The 1937 infestation map accompanying this report shows a light epidemic of beetle infestation in most of the pine stands at low to middle elevations, which decreases in intensity with increase of elevation. There are also four centers of moderate epidemic severity. The flare-ups on the Trout Creek and Antone Units are of recent origin, while the two centers on the Allison and Bald Mountain Units are of long standing in more or less fringe-type stands still suffering from the severe drought conditions.

Control is not believed necessary in the fall of 1938 or spring of 1939, as data from late fall cruises of 1938 show some indication that the increases of beetle activity in 1938 as evidenced by the summer broods were followed by a decline in the volume of ponderosa pine attacked by the winter brood. This indicates that natural factors may be bringing about a decline in the infestation. However, the situation is one that will bear careful watching. With light to moderate epidemics prevalent over much of the forest and conditions not at all unfavorable to further development of the western pine beetle, serious epidemics could easily and quickly occur.

Table No. 2—Timber stand and beetle loss statistics on sample plots—Ochoco Forest, 1932-37.

Area, Unit and Plot Location	Acres Timbered	Site	Stand Volume Bd.ft.	Beetle Losses: Year of Attack	Trees Killed	Volume Killed Bd.ft.	Bd.ft. per Acre	% of Stand Killed	Control Work: Date Treated	Percent Reduction Secured
Prineville Area										
Trout Creek Unit										
T.11S, R.18E, Sec.36E/2	320	4	5,913,336	1935	101	75,940	234	1.28		
			5,837,386	1936	61	36,375	113	.62		
			5,813,136	1937	65	55,505	173	.96		
McKay Creek Unit										
T.12S, R.16E, Sec.23E/2	320	4	4,674,995	1932	636	540,000	1687	11.06		
			4,134,995	1933	106	85,070	266	2.07	Fall, 1932.	84.25
			4,049,925	1934	33	12,250	38	.30		
			4,002,955	1935	16	16,350	51	.41		
			3,986,605	1936	19	9,000	28	.23	Fall, 1935.	44.96
			3,977,605	1937	16	22,305	70	.56		
T.12S, R.16E, Sec.31W/2	320	4	4,413,000	1932	746	453,560	1147	10.25	Fall, 1932.	49.50
			3,959,440	1933	402	228,930	715	5.73	Fall, 1933.	37,93
			3,730,510	1934	288	142,110	444	3.81		
			3,588,400	1935	51	31,400	98	.88	Fall, 1934.	77.91
			3,557,000	1936	49	30,920	97	.87		
			3,526,080	1937	66	35,245	111	1.00	Fall, 1935.	1.52
T.12S, R.17E, Sec.34S/2	320	4	2,557,700	1932	302	214,370	670	8.34		
			2,343,330	1933	66	79,000	247	3.37	Fall, 1932.	63.15
			2,302,710	1934 1/	32	16,900	53	.75		
			2,258,860	1935	25	13,760	43	.61	Fall, 1934.	18.58
			2,245,100	1936	34	14,870	46	.66		
			2,230,230	1937	25	17,690	55	.80		

1/ Not cruised in 1934. Last 1/2 of 1933 loss and first 1/2 of 1934 loss estimated.

Table 2.—Timber stand and beetle loss statistics on sample plots—Ochoco Forest, 1932-37 (cont.)

Area, Unit and Plot Location	Acres Timbered	Site	Stand Volume Bd.ft.	Beetle Losses: Year of Attack	Trees Killed	Volume Killed Bd.ft.	Bd.ft. per Acre	% of Stand Killed	Control Work: Date Treated	Percent Reduction Secured
Prineville Area (cont.)										
McKay Creek Unit (cont.)										
T.13S, R.17E, Sec.29E/2	320	4	3,041,680	1932	127	96,300	301	3.17		
			2,945,380	1933	21	16,000	50	.54	Fall, 1932.	83.39
			2,929,380	1934 2/	53	28,000	88	.95		
			2,858,160	1935	23	10,280	32	.36	Fall, 1934.	63.29
			2,847,880	1936	23	17,290	54	.61		
			2,830,590	1937	26	26,290	82	.93		
Mill Creek Unit										
T.13S, R.18E, Sec.5W/2	320	4+	3,870,845	1932	187	143,180	447	3.70		
			3,727,665	1933	109	86,110	269	2.32	Fall, 1933.	88.50
			3,575,195	1934 3/	30	9,910	31	.28		Increase
			3,558,615	1935	18	10,260	32	.29	Fall, 1934.	of 3.42
			3,548,355	1936	29	19,810	62	.56		
			3,528,545	1937	25	19,385	60	.55		
Ochoco Creek Area										
Marks Creek Unit			5,318,226	1932	364	256,596	830	4.80		
T.13S, R.19E, Sec.9W/2	320	5+	5,061,720	1933	69	57,510	180	1.14	Spring, 1935.	65.69
			5,003,760	1934	82	64,070	200	1.28		
			4,939,690	1935	26	22,200	69	.45		
			4,895,390	1936	56	37,980	119	.78		
			4,857,410	1937	27	25,840	81	.53		

2/, 3/ Not cruised in 1934. Last 1/2 of 1933 loss and first 1/2 of 1934 loss estimated.

Table 2.—Timber stand and beetle loss statistics on sample plots—Ochoco Forest, 1932-37 (cont.)

Area, Unit and Plot Location	Acres Timbered	Site	Stand Volume Bd.ft.	Beetle Losses: Year of Attack	Trees Killed	Volume Killed Bd.ft.	Bd.ft. per Acre	% of Stand Killed	Control Work: Date Treated	Percent Reduction Secured
Ochoco Creek Area (cont.)										
Marks Creek Unit (cont.)	570	4	807,951	1932	806	557,205	977	7.12		
T.13S, R.19E, Sec. 27			7,522,305	1933	207	163,215	286	2.16	Spring '35.	74.00
			7,359,090	1934	306	181,620	312	2.46		
			7,177,470	1935	68	47,020	81	.66	Fall '35.	22.00
			7,130,450	1936	56	36,200	63	.51		
			7,094,250	1937	48	31,770	56	.45		
Wolf Creek Unit			3,625,490	1933	161	99,030	309	2.75		
T.14S, R.19E, Sec.33E/2	320	4	3,526,460	1934	141	101,290	316	2.87		
			3,425,170	1935	22	22,680	71	.66		
			3,402,490	1936	60	64,730	202	1.90		
			3,337,760	1937	44	49,695	155	1.49		
T.15S, R.19E, Sec.7W/2	320 (240 cruised in 1933)	4	3,731,355 4/	1933	159	90,325	376	2.50		
			3,641,030	1934	209	100,740	314	2.75		
			3,504,290	1935	145	84,460	263	2.41		
			3,455,830	1936	61	44,900	140	.99		
			3,410,930	1937	37	25,995	81	.76		
T.15S, R.20E, Sec.18S/2	320		3,547,060	1934	80	76,790	234	2.17		
			3,470,270	1935	23	23,840	74	.69		
			3,447,430	1936	13	11,020	34	.32		
			3,436,410	1937	22	20,790	65	.60		

4/ 240 acres cruised in 1933.

Table 2.—Timber stand and beetle loss statistics on sample plots—Ochoco Forest, 1932-37 (cont.)

Area, Unit and Plot Location	Acres Timbered	Site	Stand Volume Bd.ft.	Beetle Losses: Year of Attack	Trees Killed	Volume Killed Bd.ft.	Bd.ft. per Acre	% of Stand Killed	Control Work: Date Treated	Percent Reduction Secured
Mitchell Area										
Badger Unit T.12S, R.22E, Sec. 31N/2	290	3-	7,012,500	1937	42	25,930	89	.37		
Antone Unit T.13S, R.24E, Sec.23S/2	310	4+	4,534,500	1937	91	65,095	209	1.45		
Waterman Unit T.10S, R.23E, Sec.35E/2	300	4	4,060,800	1937	49	27,510	92	.61		
Summit Prairie Area										
Mud Spring Unit T.14S, R.26E, Sec.7S/2	320	4	5,682,835	1937	30	32,760	102	.58		
Sunflower Unit T.16S, R.26E, Sec.33E/2	304	4	3,271,425	1937	45	18,635	61	.57		
Paulina Unit T.14S, R.23E, Sec.32E/2	320	4	2,677,205	1937	9	12,440	39	.47		
Antler Unit T.15S, R.21E, Sec.29E/2	320	4	3,078,550	1937	21	19,160	60	.62		
Big Summit Unit T.14S, R.22E, Sec.9W/2	320	4	3,853,695	1937	11	7,650	24	.24		

Table 2.—Timber stand and beetle loss statistics on sample plots—Ochoco Forest, 1932-37 (cont.)

Area, Unit and Plot Location	Acres Timbered	Site	Stand Volume Bd.ft.	Beetle Losses: Year of Attack	Trees Killed	Volume Killed Bd.ft.	Bd.ft. per Acre	% of Stand Killed	Control Work: Date Treated	Percent Reduction Secured
Snow Mtn. Area.										
Allison Unit	80		703,750	1932	286	150,490	1875	21.30		
T.20S, R.25E, Sec.4W/2	285	4	2,815,005	1933	126	65,050	228	2.31		
			2,967,215	1934	40	28,260	99	.95		
			2,938,955	1935	102	69,495	244	2.35		
			2,869,460	1936	89	72,300	254	2.53		
			2,797,160	1937	83	69,425	243	2.48		
T.20S, R.26E, Sec.12S/2	290	4	2,942,505	1935	34	14,200	49	.48		
			2,928,305	1936	50	17,140	59	.59		
			2,911,165	1937	49	28,030	97	.97		
Doe Spring Unit										
T.21S, R.25E, Sec.17W/2	320	4	3,885,265	1935	39	19,380	60	.50		
			3,365,885	1936	50	35,990	112	1.08		
			3,329,895	1937	33	25,810	81	.78		
Bald Butte Unit										
T.21S, R.27E, Sec.25E/2	320	4	2,396,900	1935	39	28,470	90	1.19		
			2,368,430	1936	41	32,540	102	1.37		
			2,335,890	1937	35	21,150	66	.91		
T.21S, R.28E., Sec.6E/2	300	4	2,896,835	1934	40	19,250	64	.66		
			2,877,585	1935	37	22,920	76	.80		
			2,854,665	1936	52	38,260	127	1.33		
			2,816,405	1937	40	36,240	114	1.21		
Emigrant Creek Unit										
T.19S, R.27E, Sec.34W/2	300	4	3,228,900	1937	47	48,380	161	1.59		

Table 2.—Timber stand and beetle loss statistics on sample plots—Ochoco Forest, 1932-37 (cont.)

Area, Unit and Plot Location	Acres Timbered	Site	Stand Volume Bd.ft.	Beetle Losses: Year of Attack	Trees Killed	Bd.ft. Volume Killed	Bd.ft. per Acre	% of Stand Killed	Control Work: Date Treated	Percent Reduction Secured
Maury Mt. Area										
Maury Unit										
T. 17S, R.21E, Sec.32S/2	320	4	4,455,389	1932	289	244,565	764	5.48		
			4,210,824	1933	146	114,650	358	2.71	Fall '33.	73.30
			4,079,284	1934	42	30,600	96	.75		
			4,048,684	1935	14	10,860	34	.27	Fall '34.	64.55
			4,037,824	1936	49	30,550	95	.76		
			4,007,274	1937	82	66,855	208	1.64		
T.17S, R.20, Sec.10N/2	320	4	3,801,465	1932	510	294,085	919	7.71		
			3,506,660	1933	155	97,340	304	2.76	Fall '33.	34.94
			3,409,320	1934	80	63,320	198	1.83		
			3,346,000	1935	45	30,820	96	.93	Fall '34.	36.01
			3,315,180	1936	86	48,160	154	1.46		
			3,267,020	1937	75	39,690	124	1.21		
T.18S, R.19E, Sec.7S/2	320	4	4,898,715	1935	40	27,700	86	.57		
			4,871,015	1936	22	14,200	44	.29		
			4,856,815	1937	29	25,160	79	.52		

Table 3.—Summary of cruising data on check plots.

Forest and Area	Year of Attack	No. of Plots	Timbered Acres Cruised	Volume of Stand Bd.ft.	Trees Killed	Volume Killed Bd.ft.	Trees per Section	Bd.ft. per Acre	Percent Stand Killed
Ochoco				Totals for all plots					
Prine-ville	1932	14	4320	51,039,218	4356	3,129,215	645	722	6.12
	1933	11	3680	37,143,403	1600	1,102,720	278	300	2.96
	1934	5	1600	16,664,338	604	391,325	241	245	2.35
	1935	6	1920	22,186,349	234	164,013	77	85	.74
	1936	6	1920	22,022,326	215	116,140	72	60	.53
	1937	6	1920	21,906,186	223	176,420	74	92	.81
				Totals for Continuous Plots					
	1932	5	1600	18,873,218	1998	1,447,410	798	900	7.78
	1933	5	1600	17,225,808	788	561,470	315	352	3.26
	1934	5	1600	16,664,338	604	391,325	241	241	2.35
	1935	5	1600	16,273,013	148	88,073	58	55	.50
	1936	5	1600	16,184,940	154	91,890	61	57	.57
	1937	5	1600	16,093,050	158	120,915	63	75	.75
Ochoco				Totals for all plots					
Ochoco Creek	1932	3	1210	17,903,060	1502	1,054,060	768	871	5.90
	1933	5	1850	24,130,465	789	493,125	272	266	2.13
	1934	5	1850	23,196,940	731	472,310	252	255	2.10
	1935	5	1850	22,702,430	358	253,000	123	136	1.12
	1936	5	1850	22,449,430	250	194,830	86	105	.87
	1937	5	1850	22,254,600	178	154,070	61	83	.69
				Totals for Continuous Plots					
	1932	2	890	13,397,736	1170	813,801	840	914	6.11
	1933	2	890	12,583,575	276	219,725	198	246	1.68
	1934	2	890	12,362,850	301	193,490	218	217	1.57
	1935	2	890	12,095,060	168	122,120	120	137	1.02
	1936	2	890	12,025,840	116	74,180	83	83	.62
	1937	2	890	11,951,660	75	57,610	53	64	.48

Table 3.—Summary of cruising data on check plots. (cont.)

Forest and Area	Year of Attack	No. of Plots	Timbered Acres Cruised	Volume of Stand Bd.ft.	Trees Killed	Volume Killed Bd.ft.	Trees per Section	Bd.ft. per Acre	Percent Stand Killed
Ochoco			Totals for all plots						
Summit Prairie	1932	2	480	5,312,530	181	144,125	241	300	2.11
	1933	2	480	5,297,430	66	46,305	88	96	.87
	1934	1	160	2,050,435	34	22,140	136	136	1.08
	1935	3	720	5,995,860	35	28,770	31	39	.48
	1936	-	-	-	-	-	-	-	-
	1937	5	1584	18,563,710	116	90,645	46	57	.49
Ochoco			Totals for all plots						
Snow Mtn.	1932	5	1525	14,507,000	3251	1,590,875	1575	1205	10.96
	1933	1	285	2,815,005	126	65,050	283	228	2.31
	1934	2	585	5,864,050	80	47,510	87	81	.81
	1935	6	1795	19,221,845	322	195,445	114	108	1.02
	1936	5	1475	14,386,715	282	196,238	122	133	1.37
	1937	6	1775	17,419,415	279	207,940	100	117	1.19
			Totals for Continuous Plots						
	1932	1	80	856,961	286	150,490	2285	1875	17.56
	1933	1	285	3,032,265	126	65,050	283	228	2.15
	1934	1	285	2,967,215	40	28,260	89	99	.95
	1935	1	285	2,938,955	102	69,495	228	244	2.37
	1936	1	285	2,869,460	89	72,300	199	254	2.53
	1937	1	285	2,797,160	83	69,425	186	243	2.48

Table 3.—Summary of cruising data on check plots (cont.)

Forest and Area	Year of Attack	No. of Plots	Timbered Acres Cruised	Volume of Stand Bd.ft.	Trees Killed	Volume Killed Bd.ft.	Trees per Section	Bd.ft. per Acre	Percent Stand Killed
Ochoco				Totals for all plots					
Mary Mtn.	1932	2	640	8,256,134	799	538,650	799	841	6.51
	1933	2	640	7,717,484	301	228,880	301	357	2.95
	1934	2	640	7,488,604	122	93,920	122	146	1.25
	1935	3	960	12,293,399	99	69,380	66	72	.62
	1936	3	960	12,224,019	157	92,910	104	97	.76
	1937	3	960	12,131,109	186	131,705	126	137	1.09
				Totals for Continuous Plots					
	1932	2	640	8,256,134	799	538,650	799	841	6.51
	1933	2	640	7,717,484	301	228,880	301	357	2.95
	1934	2	640	7,488,604	122	93,920	122	146	1.25
	1935	2	640	7,394,684	59	41,680	59	65	.56
	1936	2	640	7,353,004	135	78,710	135	122	1.07
	1937	2	640	7,274,294	157	106,545	157	166	1.46

Table 3.—Summary of cruising data on all sample plots—Ochoco Forest.

Year of Attack	No. of Plots	Timbered Acres Cruised	Volume of Pine Stand	No. Trees Killed	Volume of Trees Killed	Trees Killed Per Sec.	Bd.ft. per A. Killed	Percent Stand Killed
1932	26	8,175	97,017,942	10,089	6,456,925	781	790	6.62
1933	21	6,935	77,103,787	2,882	1,936,080	266	280	2.51
1934	15	4,835	55,264,367	1,571	1,027,205	208	213	1.85
1935	23	7,245	82,399,883	1,048	710,608	92	98	.86
1936	19	6,205	71,082,490	904	600,118	93	96	.84
1937	28	8,989	107,764,340	1,164	789,314	83	89	.73
Totals for Forest	132	42,384	490,632,809	17,658	11,520,250	1523	1566	13.41

Table 4.—Relation of estimated 1938 loss to 1937 loss on sample plots.

Area and Units	Plot Location Sec.	1/2	Site	Elevation	Date of 1933 Cruise: 1937	Trees Killed 1938 Total	Marked	Estimated Total	Ratio 1938 to 1937
Mitchell									
Waterman	35	E	4	4300	9-8	49	20	35	.71
Badger	31	N	3-	5100	8-27	42	22	47	1.12
Antone	23	S	4+	4300	9-1	91	46	90	.99
Prineville									
Trout Creek	36	E	4	5500	8-8	65	26	82	1.26
McKay Creek	23	E	4	4650	8-9	16	5	16	1.00
McKay Creek	31	W	4	4700	8-5	66	23	79	1.20
McKay Creek	29	E	4	3900	8-3	26	5	18	.69
McKay Creek	34	S	4	4250	8-23	25	10	25	1.00
Mill Creek	5	W	4+	4200	8-11	25	2	6	.24
Ochoco Creek									
Marks Creek	9	W	5+	3800	7-25	27	8	40	1.48
Marks Creek	27	All	4	4400	7-26	48	32	66	1.37
Wolf Creek	33	N	4	3950	8-1	44	22	85	1.93
Wolf Creek	7	S	4	4000	8-29	37	18	37	1.00
Wolf Creek	18	S	4		8-2	22	4	15	.68
Summit Prairie									
Big Summit	9	W	4	4600	8-23	11	11	25	2.50
Paulina	32	E	4	5400	8-23	9	8	18	2.00
Mud Spring	7	S	4	5400	8-30	30	11	22	.73
Antler	29	E	4	4600	8-24	21	14	31	1.47
Sunflower	33	W	4	5250	8-22	45	29	67	1.49
Maury Mtn.									
Maury	7	N	4		8-15	29	9	24	.83
Maury	10	N	4		8-12	75	32	91	1.21
Maury	32	N	4		8-13	82	68	190	2.32
Snow Mtn.									
Allison	4	W	4	5050	8-18	83	46	115	1.39
Allison	12	S	4	5600	8-17	49	21	54	1.10
Emigrant	34	W	4	5850	8-17	47	16	41	.87
Dos Springs	17	W	4	5500	8-16	33	25	66	2.00
Bald Butte	25	E	4	5700	8-19	35	34	84	2.40
Bald Butte	6	E	4	5350	8-19	40	39	96	2.40

Table 5.—Estimated ponderosa pine losses for 1937.

Area and Units	Ponderosa Pine Acreage: Total	Ponderosa Pine Acreage: Virgin	Volume of Mature Ponderosa Pine-1937 Mbm.	Estimated 1937 Loss: Number of Trees	Volume Mbm	Bd.ft. per Acre	Percent of Stand
Prineville							
Trout Creek	51,500	51,020	607,000	5100	4400	86	.73
McKay Creek	62,500	49,220	646,000	6000	4300	69	.67
Mill Creek	34,000	33,000	301,000	2440	1800	53	.59
Area total	148,000	133,240	1,554,000	13540	10500	71	.68
Ochoco Creek							
Marks Creek	68,500	63,980	851,000	4500	3800	56	.45
Wolf Creek	68,500	67,500	740,000	6700	5200	77	.70
Area total	137,000	131,480	1,591,000	11200	9000	66	.57
Mitchell							
Waterman	42,000	41,000	328,000	6000	3400	81	1.04
Mitchell	22,000	21,840	173,000	1700	1100	50	.64
Badger	26,000	24,880	357,000	3400	2100	81	.59
Antone	32,000	30,080	250,000	3350	2400	75	.96
Area total	122,000	117,800	1,108,000	14450	9000	74	.81
Summit Prairie							
Big Summit	70,000		775,000	1980	1650	24	.23
Antler	41,500		466,000	3100	2800	68	.60
Paulina	37,500		340,000	2300	1650	44	.48
Mud Spring	18,500		175,000	1480	1400	76	.80
Sunflower	25,500		188,000	3550	2000	78	1.06
Area total	193,000		1,944,000	12520	9500	49	.49
Snow Mtn.							
Allison	65,000	65,000	595,000	8960	6700	103	1.13
Emigrant	63,000	63,000	473,000	5890	5100	81	1.08
Doe Spring	31,000	31,000	337,000	4500	3100	100	.92
Bald Mtn.	60,000	57,760	455,000	7800	5100	85	1.14
Area total	219,000	216,760	1,860,000	27150	20000	91	1.07

Table 5.—Estimated ponderosa pine losses for 1937. (cont.)

Area and Units	Ponderosa Pine Acreage: Total	Ponderosa Pine Acreage: Virgin	Volume of Mature Ponderosa Pine-1937 Mbm.	Estimated 1937 Loss: Number of Trees	Estimated 1937 Loss: Volume Mbm	Estimated 1937 Loss: Bd.ft. per Acre	Estimated 1937 Loss: Percent of Stand
Maury Mtn.							
Maury	55,000	54,360	447,000	4010	3000	55	.67
Summary of losses by areas:							
Mitchell	122,000	117,800	1,108,000	14,450	9,000	74	.81
Prineville	148,000	133,240	1,554,000	13,540	10,500	71	.68
Ochoco Creek	137,000	131,480	1,591,000	11,200	9,000	66	.57
Summit Prairie	193,000	193,000	1,944,000	12,520	9,500	49	.49
Maury Mt.	55,000	54,360	447,000	4,010	3,000	55	.67
Snow Mt.	219,000	216,760	1,860,000	27,150	20,000	91	1.07
Forest totals	874,000	846,650	8,504,000	82,870	61,000	70	.72

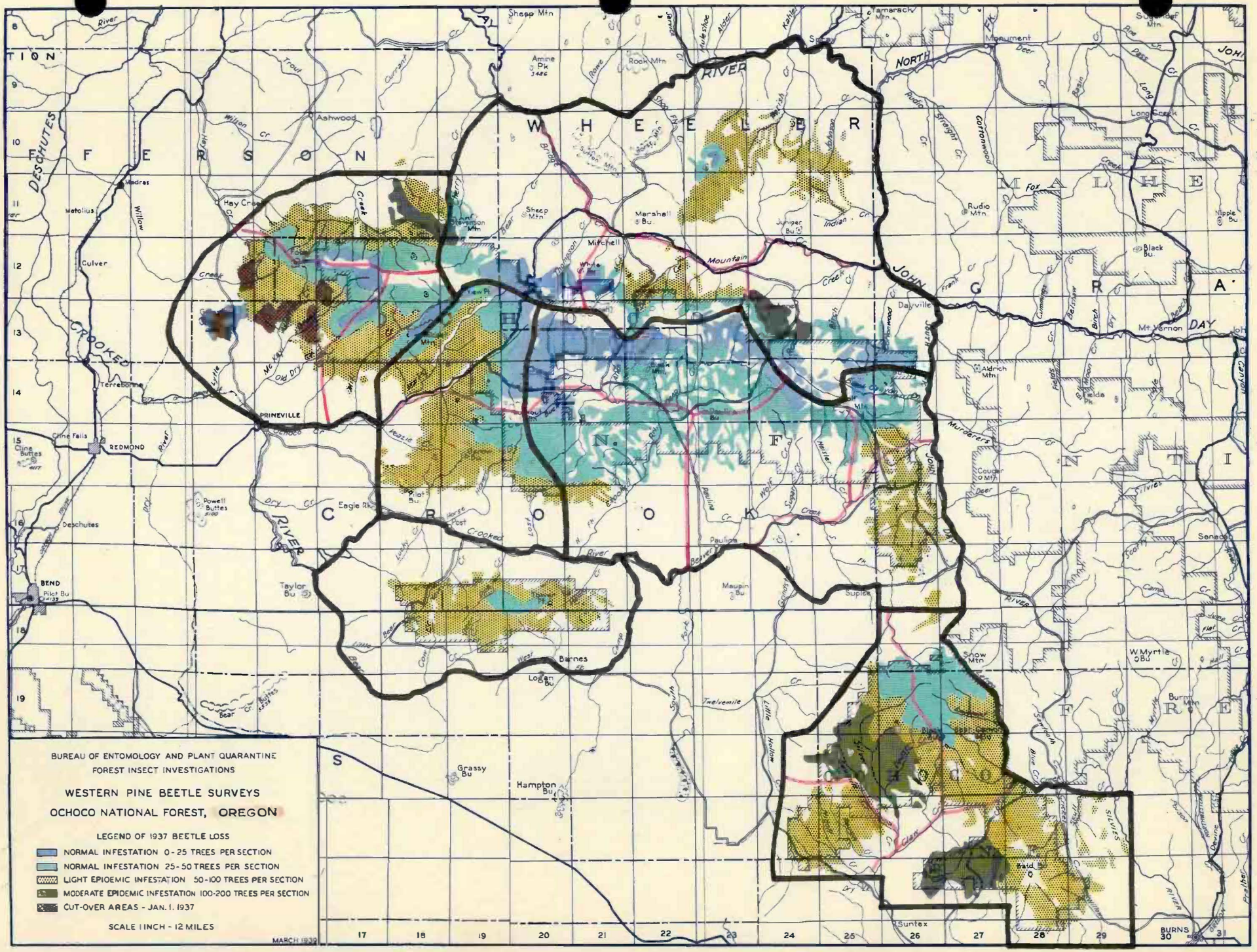
Table 6.—Estimated beetle losses by infestation areas, 1931-1937.

Areas	Total Pine Acreage	Total Pine Volume Mbm as of Jan.1,'31		Estimated ponderosa pine losses by years							Total Volume Killed 1931-1937	Percent Stand Killed
				1931	1932	1933	1934	1935	1936	1937		
Mitchell	122,000	1,271,000	Volume killed Mbm.	20,000	81,000	27,000	11,000	5,500	9,500	9,000	163,000	12.8
			Bd.ft.per A.	164	651	221	92	45	78	74	1,340	
Prineville	148,000	1,760,300	Vol.killed Mbm.	27,000	75,000	38,500	26,000	19,700	9,600	10,500	206,300	11.7
			Bd.ft.per A.	178	508	260	175	133	65	71	1,380	
Ochoco Creek	137,000	1,800,400	Vol.killed Mbm.	39,000	84,500	26,000	27,500	13,000	10,400	9,000	209,400	11.6
			Bd.ft.per A.	285	615	190	201	95	76	66	1,520	
Summit Prairie	193,000	2,080,000	Vol.killed Mbm.	30,000	50,000	18,000	9,000	7,500	12,000	9,500	136,000	6.5
			Bd.ft.per A.	155	259	131	47	39	88	49	702	
Maury Mtn.	55,000	511,000	Vol.killed Mbm.	6,000	31,000	12,500	6,000	3,000	2,500	3,000	64,000	12.5
			Bd.ft.per A.	109	560	218	109	55	45	55	1,150	
Snow Mt.	219,000	2,193,200	Vol.killed Mbm.	85,000	140,000	35,000	12,200	17,000	24,000	20,000	333,200	15.1
			Bd.ft.per A.	388	640	161	56	78	109	91	1,600	
Forest totals	874,000	9,615,900	Vol.killed Mbm.	207,000	461,500	157,000	91,700	65,700	68,000	61,000	1,111,900	11.5
			Bd.ft. per A.	237	529	179	105	75	78	70	1,272	
Percent of stand killed each year				2.15	4.79	1.63	.95	.68	.71	.63		

Table 7.—Control work on Ochoco National Forest.

Period	Area and Unit	Trees Treated	Volume Treated Mbm	Acres Covered	Cost	Work Done By	Funds
Fall 1932 to Spring 1933	Prineville: McKay Creek	4,146	3,500	17,960	$10,245.00	Forest Service	Regular
	McKay Creek	11,554	9,800	17,940	20,431.00	KFPA. *	
Fall 1933 to Spring 1934	Prineville: McKay Creek	4,726	4,503	14,920	$ 9,175.00	KFPA	
	Mill Creek	4,798	4,150	30,080	14,874.00	For.Ser.Fall '33.	NIRA.
	Maury Mtn: Maury	7,976	5,921	58,600	25,284.00	Forest Service.	NIRA
Fall 1934 to Spring 1935	Prineville: McKay Creek	1,528	1,490	6,200	3,947.00	KFPA	
	Mill Creek	1,337	1,180	30,080	7,501.00	Forest Service.	NIRA.
	Ochoco Creek: Marks Creek	3,552	2,500 **	30,100	11,366.00	Forest Service.	SCW.
	Maury Mtn: Maury	4,015	3,000 **	58,600	18,067.00	Forest Service.	NIRA.
Fall 1935 to Spring 1936	Prineville: McKay Creek	397	268	2,720	1,171.00	KFPA—Fall 1935.	
	Ochoco Creek: Marks Creek	1,536	1,180 **	40,080	5,125.00	Forest Service.	CCC.
Totals		45,565	37,492	307,280	$127,186.00		

* Klamath Forest Protective Assn.
** Estimated.


BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE
FOREST INSECT INVESTIGATIONS
WESTERN PINE BEETLE SURVEYS
OCHOCO NATIONAL FOREST, OREGON
LEGEND OF 1937 BEETLE LOSS
NORMAL INFESTATION 0-25 TREES PER SECTION
NORMAL INFESTATION 25-50 TREES PER SECTION
LIGHT EPIDEMIC INFESTATION 50-100 TREES PER SECTION
MODERATE EPIDEMIC INFESTATION 100-200 TREES PER SECTION
CUT-OVER AREAS - JAN. 1. 1937
SCALE 1 INCH - 12 MILES
MARCH 1938
DESCHUTES
JEFFERSON
WHEELER
CROOKED
OCHOCO
NORTH FORK JOHN DAY
GRANT
MALHEUR
HARNEY
CROOK
PRINEVILLE
REDMOND
BEND
Sheep Mtn
Rock Mtn
Ashwood
Madras
Metolius
Culver
Terrebonne
Cline Falls
Cline Buttes
Powell Buttes
Deschutes
Eagle Rk
Pilot Bu
Taylor Bu
Barnes
Logan Bu
Grassy Bu
Hampton Bu
Suntex
Mitchell
Marshall Bu
Juniper Bu
Rudio Mtn
Dayville
Mt Vernon
Aldrich Mtn
Fields Pk
Black Bu
Maupin Bu
Suplee
Snow Mtn
W Myrtle Bu
Burns Mtn
Seneca
Paulina
Beaver
Twelvemile
Bear Buttes
Pilot Bu
Hay Cr
Willow Cr
Trout Cr
Currant Cr
Wilson Cr
Sheep Cr
Rock Cr
Straight Cr
Cottonwood Cr
Long Creek
Monument
Deer
Fox
Indian
Mountain
Murderers
Camp
Flat
Bear
Twelvemile
Silvies
Malheur
Bridge
Cherry
Lytle
McKay
Old Dry
Beaver
Horse
Post
Crooked
Ochoco
Meadow
Lookout
Wolf
Sugar
Heifer
Partridge
Lower
Upper
Little
Big
Fork
Creek
River
Mt
Pk
Bu
Cr
Fk
Basin
Birch
Barlow
Cummings
Frank
Fields
Canyon
Deer